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P R O G R E S S R E P O R T

on

Gila Carrying Capacity Pasture

1926

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History of the Project to Date

The project was started in February, 1918 by M. W. Talbot. Available information was placed on record and the area mapped by intensive reconnaissance methods. Data regarding stocking and conditions influencing the pasture as well as other valuable information was then furnished and has been submitted each year to date by the cooperator, Henry Woodrow. Subsequent examinations were made by Talbot in June, 1920, April, 1921, and November, 1922; by Nelson in November, 1924; and by Cooperrider and Copple in April, 1926.

The Area°

The pasture lies along the Gila Forest boundary cornering on the Gila River below the box about five miles northeast of Cliff, New Mexico. (See map page ____) Original area, 1913 to 1922, 715 acres. Present area 1515 acres. Additions, 640 acres in 1922 and 160 acres in 1925. Elevation 4600 to 5100 feet. Character, rolling mesa grasslands, including a small percentage of steep slopes breaking into the main drainage troughs and very similar to large areas bordering on the south and east boundary of the Gila Forest; also quite comparable to vast areas in southwestern New Mexico.

° See Talbot's "GS-Carrying Capacity" letter of March 3, 1918.

Formation:

The exposed formation is sand-gravel-conglomerate similar to the basins between the boxes or gorges of the lower Gila River. Old eruptive rock flow probably once covered a part or all of the area.

Soils:

Comparatively deep, productive sand loam soil covers practically the entire region south of the abrupt foothills of the Mogollon Mountains where erosion or rain water leaching of soils, rendered bare of vegetation by destructive grazing, have not caused disturbances resulting in recent excessive damage. Eruptive rock, even if not present originally, has probably been carried down from higher elevations in finely disintegrated state, contributing a clay-like tenacity and influence to the soil. For semi- arid range land the pasture and the region may be said to have soils that are deep, highly productive and not overly subject to removal by erosion. Although sand loams, the influence of other formations, and age-old established cover have produced a soil character not readily subject to disturbance either by wind or water.

~~Remnants of malpais may still be found on higher nearby~~ mesas. Subsoils and the underlying sand-gravel formation are probably very deep. → (no paragraph)

Once exposed by a rapid removal of soil, due to destruction of perennial vegetation, the sand-gravel lends itself readily to the influences of eroision.

Men of wide experience who have known for thirty years the

° Remnants of malpais may still be found on higher nearby mesas.

region, of which this pasture is but a small fraction, consider it to have been among the best of the yearlong ranges of New Mexico.

History of Use:

The original area of 715 acres was fenced in August, 1913. It is reported to have been badly overgrazed at that time, a part having been an old roundup grounds, however, the sod, although damaged, must have been pretty well in tact and erosion must not have been serious. From the time of fencing until 1915 little use was made of the forage and 1914 which is yet spoken of as an exceptionally good year is emphasized in the original report as producing an excellent seed crop over the pasture.

TABLE I

Forage and Use

Year	Acres	Average# Density	Forage Acres	No. of Stock C.Y.L. Terms	Comments
13	715			Practically Unused	
14	"			Practically Unused	Went to seed. A series of wet years ended with 1914-15.
15	"			40	
16	"			40	A little below normal.
17	"			45	Estimated ½ feed crop.
18	"	.377	270	36	Poor growth.
19	"			44	Poor growth (½ forage crop)
20	"	.320	230	33	Light rains only. Short forage crop.
21	"	.278	200	53	Spring rains poor, few weeds. 8 head lost (starvation) Good summer-no fall or winter rains.
22	"##	.265	190	34'''	Feed not so good from summer rains as 1921
23	1355			53-2/3	New feed Mar.& Apr-July & Aug. Fairly good conditions. No losses.
24	1355	.187° .125°°	253° 89°°	39	New feed Mar.& Apr. Stock good condition in Nov. Loss one, not from poverty.
25	°°° 1515	.169° .109°°	260° 80°°	50	1/1/25 to 7/25 little rain. Very dry summer & winter rains & feed fair. Fed 2 cows 3 Mo. Lost 4 cows-7 twos, heifers.
26	1515				Good moisture conditions & annual feed 4/3/26.

\# Average density is really the forage factor since most of the estimating was done on a forage factor basis.

640 acres added in 1921 but not used until July, 1922.

''' The stocking during 1922 is somewhat of an estimate because an additional area of 640 acres was opened to stock but used only slightly prior to July. (M.W.T.)

° Basis of total acreage (1355 acres)
(1515 ")

°° Basis original acreage (715 acres)

°°° 160 acres added Dec. 1925.

Comparative Stocking Data:

(Extract from Talbot's report of July 23, 1923 - table brought up to date.)

The following table shows a comparison of actual use and estimated carrying capacity upon the arbitrary basis of 10 forage acres per cow yearlong as used by Reconnaissance on similar areas (the estimated carrying capacity column is added only as an aid in comparing actual use with condition of range. It is not used in the natur of what is correct stocking because the project was initiated to check the accuracy of such carrying capacity estimates.)

TABLE II

Year	Actual Use			Estimated C.C. on Basis of 10 F.A. per cow	
	No. of A.	FA per A	SA per A	SA per A.	No. of A.
1918	36	7.5	19.8	27	27
1920	33	6.9	21.6	31	23
1921	53	3.7	13.4	35	20
1922	34	5.5	21.0	38	19
1924	39	6.5	34.7	53	26
1925	50	5.2	30.0	58	26

A = Animal stocking reduced to a cattle yearlong basis.
FA = Forage acres.
SA = Surface acres.
C.C.= Carrying capacity.

In discussing the Forage and Use and Comparative Stocking Tables, Talbot in his 1922 progress report emphasized two points as basic facts with which we must deal in analyzing the data, namely:

"First, the period from 1915 to 1922 may be called a dry cycle of climate, at least relatively dry when compared to

the several years preceding 1915. (It is perfectly reasonable to suppose, therefore, that forage growth conditions during the period as a whole must have been also poor.)

"Second, the area has been grazed by a fairly consistent number of stock as will be noted from the first table."

In applying these statements to the period since 1922 certainly no marked improvement in amount of rainfall or seasonal tendency has occurred. 1924 and 1925 were probably as unseasonable years as any in the ten years since 1915.

For the period of eight years prior to 1922 the stocking of the pasture had been fairly constant averaging 40 head, yearlong basis. The stocking of the original pasture is indeterminable since 1922 as 640 acres were added that year and 160 in 1925 which additions more than double the original acreage. Since 1922 the average stocking of the present pasture has been 48 head or an increase of 20% in stock as against 211% increase in acreage, while the acreage added has a greater average density of forage or carrying capacity than the original now supports. It will be readily seen that something has happened to the forage stand.

Depletion of Range:

It would be well to state that the manner of estimating in 1918 the time of the first examination was that used in intensive reconnaissance. The pasture was then a grass range with practically no perennial weeds. Perennial grass density was considered virtually the same as forage factor (density x

palatability) since utilization was complete for all species.# The estimates made April 3, 1926 were based on the perennial grass stand considered in like manner. Due to a changed ecology complete estimates were also prepared. It seemed desirable to collect data on the annual vegetation as to stand and use since this phase now becomes important here as well as in any application of results on many other like ranges.

Talbot emphasized the fact that these estimates of density of vegetation are ocular and some slight discrepancy is possible from the personal equation. It would be expected that a change in personnel of examiners might tend toward greater error in comparative results, however, this is believed to be reduced to a minimum by the fact that Talbot and the examiner have proven through years of association that their estimates of density factor are very similar.

Table I shows a gradual reduction in density of perennial grasses from .377 in 1918 to .265 in 1922 (Talbot's estimates) and to .109 in the original pasture in April, 1926. Talbot's notes call attention to the prevalence of dead grass tufts in 1920 and 1921, the same having contributed to the 1918 density.

Another bit of strong evidence of depletion is the fact that I knew many ranges in this region prior to Talbot's first examination in 1918 and the data collected at that time corresponds as to species, density and use with my mental picture

#See Talbot's "GS-Carrying Capacity" letter of March 3, 1918.

of similar range which was then on the decline, large acreages having since met the same or a worse fate than that exemplified by the pasture at present. The 1918 type map and notes show the mesa ridge type, the majority of the area, to have been grass with aristida (3 Awn) very predominant. The aristida in 1926 is almost gone. It is interesting to note that the one-tenth density remaining in the old aristida type is largely gramas and curly mesquite and that the one small grama type mapped in 1918 is the only association that was not so changed as to require new type lines in 1926, although it has declined from four-tenths to two-tenths density.

CARRYING CAPACITY AND FORAGE ACRES

Type density was based in the beginning on the perennial grasses as perennial weeds were so few as to be negligible. Density at that time was considered the same as forage factor due to the complete utilization of all grass species. This was probably not far from being correct in final forage acre result as the annuals, the small amount of cactus and other browse were eliminated from the estimate. They probably amounted to enough in carrying capacity to balance a reduction resulting from the application of a palatability factor. The statement is made in the original report after the 1918 examination that while annuals were out of season at that time, stockmen in the vicinity considered spring annuals to practically carry stock for two months and to again be quite important after the summer rains.

In anything approaching their natural state these grass ranges had probably best be estimated on a basis of grass alone. At present the problem of range use, in some manner to allow areas capable of producing established vegetation to pass from annual to perennial if not climax types, is so general that some attention must be given it. That annuals have played a part in the carrying capacity of the pasture from the beginning, there is little doubt. The two years of heavy losses.were seasons of late and scanty spring annual growth. There is little to prove that annuals are important in climax type on such a range. A thinning or decrease in density of the grasses not readily noticeable had probably already taken place in 1918 accounting for the prominence of annuals. At present the original pasture

is an annual type. Spring rains cause good annual weed feed for about two months and summer rains result in annual grass, well named six weeks grass. The amount of feed produced in either spring or fall is very uncertain and stock on this type of range are entirely dependent on the forage produced by perennials between the growing seasons.

Section 35 added in 1922 has, due to the water situation, never received as hard usage as the original pasture. It still has a fair grass cover. The two areas combined at present offer an opportunity for study of the carrying capacity of annuals.

On the original basis of total utilization the April, 1926 data shows the following:

	Forage Acres	
	Perennials	Annuals
Original pasture, 715 acres	80	64
Section 35 added 1922, 640 acres	160	33
N.W.¼, Sec. 1 added 1925, 160 acres	19	16
Total	259	119

For a figure with which to work 80% is taken as a probable palatability of perennials. 80% of 259 equals 207 or 20.7 cattle yearlong on a 10 forage acre basis.

Likewise taking 50% as a palatability figure for annuals 50% of 119 equals 69 or 6.9 cattle yearlong terms.

The annuals involved are quite palatable and 50% is used rather as a possible and desirable amount than as a palatability factor, taking into account the following.

Annuals in volume production or feed produced are an uncertain quantity. When good crops are produced total utilization is impossible during period of growth unless additional stock are placed on the range. A range where annuals have replaced perennial stands is very subject to soil removal and destructive erosion, and, therefore, should be given the advantage of protective cover during rains (that is the period of annual growth). Annuals are contributors in the line of plant succession and if perennials are ever to be established the annual growth must be disturbed as little as possible.

From a calculation as that given, including both annual and perennial vegetation, we get a carrying capacity of 27.7 cattle yearlong or virtually the same as that shown in Table III.

Summer annuals are a factor, if small, and that must be determined. Such deductions as that just given must be substantiated by a determination of the palatability factor by species.

It seems probable that this important problem of annuals can be solved for reconnaissance use by developing an equation that may be added to the value of perennials for each broad general type, or by working out a forage acre requirement to be applied to forage acres, based on perennial vegetation.

From the eight years of data on the original pasture,

it would seem that 10 forage acres is at least a reasonably safe figure. Deterioration has been too swift, at the rate of an average of 5.9 forage acres, to determine to a fine degree just what the pasture would have stood. For a great many reasons such fine determinations lose much of their value in work somewhat influenced by the personal factor. Although the figures are somewhat complicated by additions to the original pasture a direct mathematical relation exists between forage acres and actual stocking.

Original pasture - 1918 - 270 forage acres.

Present pasture - 1926 - 260 " "

Original pasture - 1926 - 80 " "

260 - 80 equals 180, or forage acres in addition to original pasture.

180 + 270 equals 450, or forage acres in present pasture had there been no thinning of density.

The average forage acre use based on actual stocking has been 5.9 per head.

Then inddetermining a forage acre requirement the forage acres in the original pasture should bear a relation to the present pasture in a like condition as the average use is related to desired usage.

270 : 450 :: 5.9 : X.

X = 9.8 forage-acre requirement.

LEGEND

- (T) Temporary Water
- (P) Permanent Water
- A Tank
- △ Photograph Station
- ⊡ Quadrat
-)(Gate
- x-x-x Fence line original pasture joining additions

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- Annual-weed type
- Perennial Grass-annual type
- Browse type
- Waste

HENRY WOODROW PASTURES

Apr. 5, 1926

C. K. C. - R. F. C.

Some Economic Phases of Range Depletion:

The original pasture had 715 acres and required approximately 7-1/8 miles of fence to enclose it. The pasture was very ill-shaped for economic fencing.

The present pasture consists of 1515 acres and is inclosed by about 10-1/8 miles of fence.

The land is $3.00 an acre , state purchase. The fences for comparison are valued at $175 per mile.

Referring to table No. II, 27 head of cattle was the carrying capacity at 10 forage acres per animal in 1918 and 26 head in 1925. The average number of stock grazed beginning with 1915 is 42 head.

TABLE III

Comparative Investment 1918-1925

Year	Acreage	Investment land & fence	Carrying Capacity Basis 10 F.A.°	Investment per Head	Interest @ 8% on per head Investment
1918	715	$3,392	27	$126	$10.08
1925	1515	6,317	26	243	19.44

°F.A. = Forage Acres.

The average number of stock grazed, 1915 to 1925 in terms of cattle yearlong is 42 head. On this basis the average per head investment in land and fences derived from an average investment of 1918 and 1925 is $115 which same @ 8% is $9.20.

The average calf crop of those listed is about 50%. Suppose 15 calves were produced with the stocking given above, (should be more) worth $30 the average return per animal in the herd would be about $17.00

IV

Year	Int.@ 8% on per hd. investment in land & fences	Int.@ 8% on Investment in 1 animal	Total Columns 1 & 2	Yearly sales return per herd animal	Profit or Loss return above interest on Investment
1918	$10.08	$3.20	13.28	$16.66	+3.38
1925	19.44	3.20	22.64	17.30	-5.34
Against 42 head	9.20	3.20	12.40	15.00	+2.60

The attempt is made to justify economically an operation of either 27 or 50 cattle. The figures are used simply as a

matter of profit and loss comparison.

The indications are very strong that had the area been stocked at the rate of 27 head or 10 forage acres per animal rather than an average of 42 head or 5.9 forage acres per animal the 715 acres would be carrying the 26 cattle in as good or better shape today. By over pasturing, it has been necessary to more than double the acreage to practically the same original amount of feed. While the amount is significant only in a comparative way, correct stocking, as shown in Table III, would have returned a profit each year over and above interest on the investment of $3.38 per head of herd grazed. An effort to increase returns through numbers alone has resulted in eight years' time in a drop in per head return on investment to $2.60 or 33% loss. This tells but a fraction of the story as Table I shows severe losses of herd stock during two years out of the eight. Such losses would reduce the average return very materially. The greater item of loss is the very apparent fact that overstocking eventually (the time element depending on the degree of over use) destroys the value of the land and, therefore, the capital investment in land and improvements.

Although a small range, this area is very characteristic of many thousands of acres and many entire operations. In such instances the natural course economically is liquidation

with a drop in land values or a return to stocking such as indicates in Table III for 1925 and a charging to bad business management of the loss involved until such a time as recuperation of the range and increased production through better practices again show a profit.

Erosion

The data in this instance seems to be in line with my general observations and to be added proof substantiating my belief that abnormal increase in erosion and soil depletion caused by a thinning of perennial vegetation is fast becoming the most serious range problem in mountainous regions of the Southwest. This statement refers entirely to permanent decrease in range values and not to effect on stream flow or agricultural enterprise dependent on watershed conditions.

The map on page ____ shows the drainage of the old pasture to be largely complete within itself, thus reflecting in erosion tendency the cover influence.

The following extract is made from Talbot's 1922 report:

> "In 1918 the main drainage through the pasture was a shifting gravel bar for about 1/2 mile from the lower boundary fence. (This has more than doubled, see map ____). The same condition was found in portions of various other stream lines but the cause of all of this advanced erosion lay too far in the past to risk an opinion.
>
> " "However, over the slopes in general at that time erosion was not at all a serious problem. At the time of my examination in 1918 there were many gullies which had been eroded years before and a few which were actively cutting. However, grass had become established in many of these little gullies and they were not increasing noticeably in number or size. Each succeeding examination noted erosion conditions more serious than the previous one, and in 1922 erosion of slopes was seriously endangering the future grazing value of the entire pasture."

Talbot took some pictures of trough cutting and gully erosion in 1920;and 1922 these photographs were taken to the field in April, 1926 and although the exact camera sets could not be found the sites are close enough to tell the story.